JAPANESE [JP,2001-277059,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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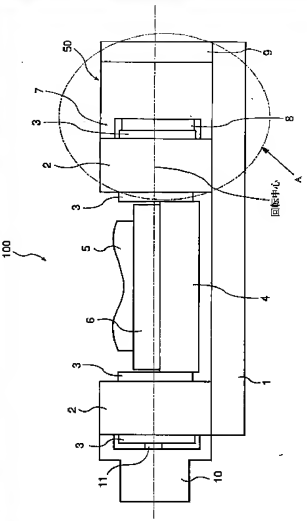
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention leans a work by a less than 360-degree predetermined angle of rotation, and relates to the rotating table for holding the state where it leaned.
[0002]
[Description of the Prior Art]In a machine tool, the rotating table which leans a work is an important mechanism, in order to meet the needs of future complicated shape working. In this rotating table, when the axis of rotation is level, if a center of rotation and a centroid position are not in agreement, gravity offset will occur with gravity. Especially the thing for which a center of rotation and a centroid position when a working piece is set on the axis of rotation are coincided in a machine tool since broad correspondence

Drawing selection
Representative drawi



[Translation done.]

is searched for about the shape of a working piece and a size is impossible usual. Although the dead-weight-compensation mechanism using a pneumatic cylinder or a hydraulic cylinder is proposed in the direct-acting stage to this gravity offset, In a rotating table, when torque attaches the method and counter balance which oppose gravity offset by a large motor, the method which coincides the center of gravity and a center of rotation is common. For this reason, in JP,7-110714,A, the method which drives the same axis by two motors is proposed.

[0003]

[Problem(s) to be Solved by the Invention]However, in the method which attaches counter balance, there is a problem that the weight of a flexible region becomes large, the response of a rotating table is bad and the control frequency of a table becomes low with the fall of the character frequency by the increase of weight. Since it becomes a motor becomes large and large [required current], in order to oppose gravity offset by a motor, calorific value becomes large, and there are a heat-resistant problem of the coil of a motor and a problem of having bad influence on the accuracy of a machine tool according to heat modification of a rotating table. Also in the composition of JP,7-110714, A which set the motor to two, this is the same.

[0004]Therefore, it is providing the rotating table which this invention's can be made in view of the technical problem mentioned above, and the purpose's can reduce the influence of gravity offset of a rotating table, and can aim at improvement in a control characteristic and positioning performance.

[0005]

[Means for Solving the Problem]In order that a technical problem mentioned above may be solved and this invention may attain the purpose, a rotating table concerning this invention leans a work by a less than 360-degree predetermined angle of rotation, and is characterized by that a rotating table for holding the state where it leaned comprises the following.

Pedestal.

The axis of rotation supported by said pedestal enabling free rotation.

A buck with which it is a buck which is arranged on this axis of rotation and supports said work, and a back face which supports said work has been arranged almost in

parallel with a center of rotation of said axis of rotation. A driving means for holding said axis of rotation to said predetermined angle of rotation, and a ** pressure means to make this axis of rotation generate the angular moment by giving hydrostatic pressure to said axis of rotation.

[0006]In a rotating table concerning this invention, said driving means is the motor provided with a rotary encoder for detecting angle of rotation, and either [at least] said rotary encoder or said motor is hollow, and it is characterized by having arranged the aforementioned with pressure means to that inside.
[0007]In a rotating table concerning this invention, it is characterized by providing further a control means which controls said hydrostatic pressure by the aforementioned with pressure means according to angle of rotation of said axis of rotation.
[0008]In a rotating table concerning this invention, said driving means is a motor and said control means is characterized by controlling said hydrostatic pressure so that load of said motor serves as the minimum.
[0009]
[Embodiment of the Invention]Hereafter, the suitable embodiment of this invention is described in detail with reference to an accompanying drawing.
[0010](A 1st embodiment) Drawing 1 is a figure showing the outline composition of the turntable device 100 concerning a 1st embodiment of this invention.
[0011]In drawing 1, 1 is a base attached to a machine tool, and becomes multiaxis machine tools by attaching to the stage (not shown) of a machine tool. 2 is a housing part of the static pressure shaft receptacle which is a guide of a rotating table, and is being fixed to the base 1. In this embodiment, since the deployment to a high precision machine tool was considered, the static pressure shaft receptacle was used, but other bearings may be sufficient. It is the zipper which 3 was inserted into the rotor part of a static pressure shaft receptacle, and 4 was inserted into hydrostatic bearing on either side, and was connected. The work whose 5 is a processing object, and 6 are the work jigs for holding the work 5 and fixing to the zipper 4. The stator part of the motor 50 for 7 to drive a rotating table and 8 are a rotor part of the motor 50, and a gravity balancer whose 9 is a characterizing portion of this embodiment, and it is

being fixed to the stator part 7 of the motor 50. The rotary encoder with which 10 carries out sensing of the angle of rotation of the zipper 4, and 11 are the chart axes of a rotary encoder.

[0012]The turntable device 100 constituted as mentioned above is in the state to which only the angle of rotation theta of less than 360 degrees leaned the work 5, it is for holding the inclination posture, and servo control of the motor 50 is carried out so that it may hold, where only the angle theta is leaned the rotor part 8. Under the present circumstances, if the center of gravity of the rotating part including the work 5 of the turntable device 100 has shifted from the center of rotation, when holding the work 5 to the degree of angle of inclination of the angle theta, The angular moment proportional to the amount of gaps of the center of gravity and the weight of the work will start the motor 50, the motor 50 must generate the holding power which always counters this angular moment, and generation of heat of a motor, etc. occur. The gravity balancer of this embodiment is for canceling the angular moment resulting from a gap of this center of gravity.

[0013]Drawing 2 is a detail view (detail view of the A section in drawing 1) of the gravity balance sir which is a characterizing portion of this embodiment. Drawing 3 is an A-A sectional view of drawing 2.

[0014]In drawing 2 and drawing 3, the thrust pad of hydrostatic bearing and 20b 20a The radial pad of hydrostatic bearing, The coil by which 21 was fixed to the stator part 7 of the motor 50, the magnet with which 22 was fixed to the rotor part 8 of a motor, The pressure receptacle side where 23 was fixed to the rotor 3 which is a flexible region of the turntable device 100, The pressure-producing part by which 24 was provided at the tip of the gravity balancer 9, the air supply hole by which 25a and 25b were prepared for the pressure-producing part 24, and 26 are the air passages for leading air to the air supply holes 25a and 25b. Here, the pressure-producing part 24 and the rotor 3 are the noncontact states in which the crevice had around 15-micrometer clearance.

[0015]If air is supplied from the air supply hole 25a by the above-mentioned composition, the rotor 3 can be moved to the hand of cut of the clockwise rotation shown in drawing 3. Conversely, if air is supplied from the air supply hole

25b, the rotor 3 can be moved to the counter clockwise hand of cut shown in drawing 3. Gravity offset of the flexible region of a rotating table can be canceled, and what is necessary will be just to carry out positioning control only of the minute amount of positioning by a motor by this with the power by such air pressure.

[0016]Here, the generating torque of a gravity balancer will serve as about 20 kgf-cm, if the area of the pressure receptacle side 23 shall be 1.5 cm x 3 cm and it sets length from 3kgf/cm^2 and the center of rotation to the center of the pressure receptacle side 23 to 1.5 cm for an air supply setting pressure. If the weight of 10 kg of a flexible region and eccentricity (distance from a center of rotation to the center of gravity) are 2 cm, the function of a gravity balancer is in capability and is more possible as a gravity balancer practically than as this.

[0017]Next, gravity offset is explained using drawing 4. Drawing 4 is the figure which expressed typically the center of rotation of the flexible region of the rotating table 100, and the relation of the centroid position.

[0018]When a centroid position is in a lowest point in the movable range of the flexible region of a rotating table like drawing 4 (a), all hydrostatic bearing has received the weight of the flexible region of a rotating table, and the gravity offset (angular moment by gravity) used as the load of the motor 50 does not occur. Next, the gravity offset (angular moment by gravity) as which positioning angle of rotation is expressed in the following formulas like drawing 4 (b) when only theta shifts to the position of drawing 4 (a) occurs.

[0019]gravity offset =mg-sin theta-R -- here, as for the flexible region mass of a rotating table, and g, positioning angle of rotation and R of gravitational acceleration and theta are [m] eccentricity (distance from a center of rotation to the center of gravity). As shown in this formula, when the positioning angle of rotation theta changes, the quantity of gravity offset changes.

[0020]For this reason, the composition for corresponding to change of the gravity offset amount by this angle of rotation is explained below.

[0021]Drawing 5 is an air pipe figure of the gravity balancer of this embodiment. As for an air supply source and 32, 30 is [a pressure gauge and 34] the control BOX a servo valve

and 33 a gravity balancer unit and 31. Here, a gap and weight of a centroid position when the work 5 is attached zipper 4 are computed, the setting pressure value of the gravity balancer corresponding to the gravity offset at a given angle is calculated, and it controls by a controller. The current value of a motor may be monitored, and a setting pressure value may be changed so that the current value may become small.

[0022]By composition of this embodiment, the miniaturization of a motor and reduction of the calorific value of a motor are attained. Since change of the gravity offset by the difference in positioning angle of rotation is also cancellable with a gravity balancer, the positioning control characteristic of a motor can also be raised.

[0023](A 2nd embodiment) Drawing 6 is a figure showing the composition of a 2nd embodiment.

[0024]In drawing 6, it is a rotary encoder of the hollow where 40 detects the housing of the static pressure shaft receptacle of a principal axis, 41 detects the rotor of a principal axis, and 42 detects the position of a hand of cut. Here, the stator 5 of a motor is fixed to the housing part 40 of a principal axis, and the rotor 6 of the motor is being fixed to the rotor 41 of a principal axis. The rotary encoder 42 is being fixed to the end face of the stator 5 of a motor.

[0025]It is fixed to the housing 40 (motor stator 5) of a principal axis, and the rotor 41 of a principal axis, respectively, and the gravity balancer 9 (the pressure-producing part 24 is stationed at the tip) and the pressure receptacle side 23 are removable composition.

[0026]By the removable gravity balancer of this composition performing positioning operation when the work or small spindle of an unbalanced load is attached to a principal axis, and performing spindle operation, where a gravity balancer is removed, The principal axis of the machine tool which had a function of both positioning operation and spindle operation with the size motor can be made possible.

[0027]As explained above, according to 1st and 2nd above-mentioned embodiments, it is possible by using a gravity balancer for a rotating table to cancel gravity offset. Thereby, the miniaturization of a motor and reduction of the calorific value of a motor can be attained. Since change of the gravity offset by the difference in positioning angle of rotation is also cancellable with a gravity balancer, the

positioning control characteristic of a motor can also be raised.

[0028]Therefore, the rotating table of the above-mentioned embodiment has small heat modification, turns into a rotating table with high flattery nature and response, and can perform processing of high accuracy of form and profile irregularity.

[0029]

[Effect of the Invention]As explained above, according to this invention, the influence of gravity offset of a rotating table can be reduced, and improvement in the control characteristic of a rotating table and positioning performance can be aimed at.

[Translation done.]